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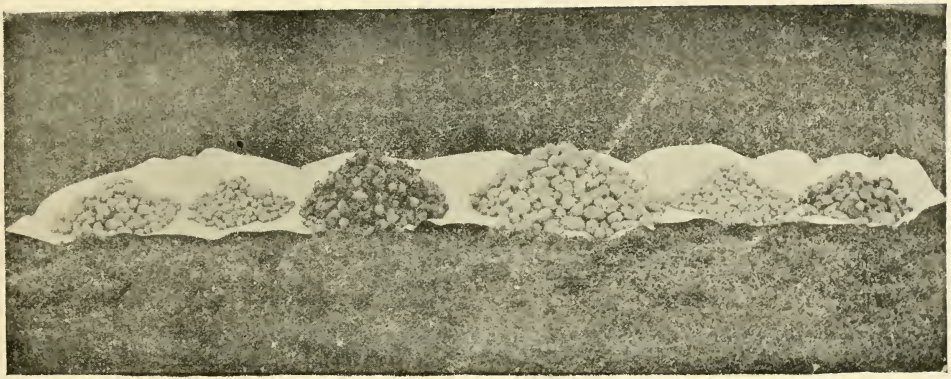
BULLETIN NO. 22.

PREVENTION OF POTATO BLIGHT.

MAY, 1894.

N. H. COLLEGE OF AGRICULTURE AND
THE MECHANIC ARTS
DURHAM, N. H.



UNSPRAYED.
Merchantable—30 lbs. Small—17 lbs. Rotten—61 lbs.

SPRAYED WITH BORDEAUX MIXTURE.
Merchantable—103 lbs. Small—30 lbs. Rotten—20 lbs.

FIG. 2.

POTATO BLIGHT.

The potato crop is liable to serious losses from two sources, which losses are to a great extent preventable. These two sources of loss are the Colorado beetle, or potato bug, and the *blight* or *rust*. Every farmer knows how to deal with the potato bug. Paris green is the sovereign remedy, but it is only within a comparatively few years that a successful treatment has been found for the *blight*. It seems now, however, that an effective remedy has been found in the Bordeaux mixture.

The blight is caused by the growth in the potato vines of minute parasitic plants, known as fungi. There are two distinct species of fungi which produce the blight in potatoes,—one, known botanically as *Macrosporium solani*, causes what is now known as the early blight, the other, *Phytophthora infestans*, causes the late blight which has been the most common and destructive. Blight, rust, and rot are the various names by which it has been called. This disease seems to have been especially prevalent during the last few years, doubtless owing to the peculiar conditions presented by the weather, a warm and moist season being most favorable to its development.

It usually makes its first appearance during the month of August when the vines of the later varieties are in full growth. Early varieties often escape its attacks altogether. The leaves are the first to show its effects. They become more or less discolored, then begin at the edge to turn brown and curl up, or, if the weather be very damp, to rot. If a leaf which is only partly dead is closely examined there will be seen on the under surface, especially along either side of the line separating the dead portion from the living, a very fine white fuzz; this consists of the spore stalks of the fungus which is growing within the tissues of the leaf and which constitutes the sole cause of the disease. If a portion of the leaf thus affected be placed under

a suitable power of the microscope, the fine white branching stalks may be plainly seen growing out of the breathing pores or stomata in the epidermis, sometimes one and sometimes several growing from a single opening; on the sides and tips of their branches will be seen little white egg-shaped bodies; these are the spores or seed of the fungus causing the blight. If the interior of a leaf be examined there will be found running in all directions among the cells, especially those of the under side of the leaf, fine white threads which are the mycelium or body of the fungous plant. These threads absorb from the cells among which they run the nutriment which has been elaborated for the use of the potato itself, and cause them to die and shrivel up or decay. The spores as soon as they are mature are very readily broken off from their stalks, and being so light are easily borne by the wind to healthy vines where they germinate in any moisture they may find upon the leaves or stems and make their way through the skin or epidermis into the succulent tissues beneath, where the threads develop and in their turn send out a crop of spores which help to spread the disease.

If the weather is sufficiently warm and damp this development and spread is very rapid, so that a large field of apparently healthy vines may be entirely killed in a very few days. If this destruction of the tops occurs early, the tubers cannot mature and the yield will be a light one and of inferior quality; moreover, the fungus is not confined to the tops but makes its way into the tubers also. The potatoes thus attacked are very likely to decay, and great loss occurs, not only before they are dug but even after they are stored in the cellar, if the conditions there should be favorable. The threads of the fungus live over winter in the tubers which, if used for seed, serve to start the disease again the following summer.

Figure 1 represents a magnified section of a potato leaf affected with the blight. The leaf like all parts of the plant is made up of cells of various sizes and shapes. The upper and lower surfaces are covered by single layers of cells called *epidermis* shown at *a* and *d*. The upper side of the leaf consists of elongated cells arranged perpendicularly to the surface and closely packed

together *b*; the lower side *c* consists of irregular cells, loosely packed, having air spaces between them. Communicating with the air spaces are little openings in the epidermis, called *breathing pores* or *stomata*, one of which is shown at *e*. In the left half of the section the cells are represented filled with the *chlorophyll bodies* which contain the green coloring matter. Running among the cells are seen the threads or *mycelium* of the fungus which causes the blight; and growing from the breathing pores the branching *spore stalks* bearing the *spores*.

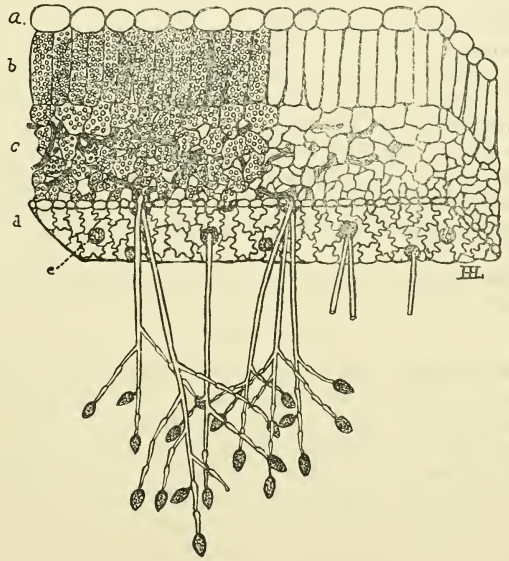


FIG. 1.

Treatment.—If it can be avoided, potatoes which are known to be diseased or which have been grown in a field attacked by the blight should not be used for seed. However, a remedy has been found which if used in season seems to be very efficient in checking or preventing the disease. This remedy is the Bordeaux

mixture, which, when applied to the vines, destroys the vitality of the spores with which it comes in contact and thus prevents the infection of healthy plants. It should be applied, if possible, before the disease makes its appearance, at least by the last of July, and the applications should be repeated at intervals of ten to fourteen days, and oftener if the mixture is washed off by rains, until the tubers have matured. Usually three applications will be sufficient but a fourth may sometimes be required.

In experiments made in the summer of 1892, the vines on the sprayed plots remained green from one to four weeks longer than those on the unsprayed plots.

In one case the yield of merchantable potatoes from the sprayed plot was about one third greater than that from a similar unsprayed plot, while on two other sprayed plots the yield was one half greater than on the unsprayed plot.

In another case, in a different field, a small sprayed plot yielded three times as many merchantable potatoes as the corresponding unsprayed plot, while the weight of rotten potatoes on the unsprayed plot was three times as great as on the sprayed plot.

A photograph of the potatoes from these two plots is reproduced in Fig. 2.

EARLY BLIGHT.

The early blight (*Macrosporium solani*) has come to be recognized as a serious disease of the potato only within the last two or three years. It was first noticed at this station in the summer of 1892. As its name indicates, it makes its appearance earlier than the ordinary blight—by the middle of July or earlier. It first appears, as sharply-defined, rather irregular, dark brown or blackish spots on the leaves. The surface of the spots is usually marked with minute wrinkles, which take roughly the form of numerous circles with a common centre; this has been called the "target marking," from its resemblance to the concentric rings of a target. The spots increase gradually in number and size till the whole leaf is destroyed.

The fungus producing this disease differs considerably in the details of its structure from the late blight, but

like it, consists of mycelial threads which grow in the tissues of the leaf and send out spore-bearing stalks on the surface. The early blight may be distinguished from the late blight by its characteristic spots, by the absence of the mould-like fuzz of the latter, by its earlier appearance and slower growth, and from the fact that it does not affect the tubers. Both diseases may be present in a field at the same time.

Our experiments have not yet definitely decided the question whether the Bordeaux mixture is as effective a remedy for the early blight as for the late, but the indications are favorable. Our experiments last summer were planned for the ordinary blight, but that did not make its appearance in this vicinity and it was rather late when our attention was directed to the new disease. Several plots were sprayed about the middle of August, and while the vines were finally killed, those which were sprayed resisted the disease about two weeks longer than the unsprayed.

One of the sprayed plots yielded twenty bushels per acre more than a similar unsprayed plot, while in another field a small sprayed plot yielded nearly double the weight of merchantable potatoes that the unsprayed plot beside it did. In treating the early blight the spraying should be commenced by the middle of July, or earlier, if signs of the disease make their appearance.

BORDEAUX MIXTURE.

Blue vitriol (copper sulphate)	1 lb.
Fresh lime	1 lb.
Water	10 gals.
or	
Blue vitriol	5 lbs.
Fresh lime	5 lbs.
Water	50 gals. or 1 barrel.

Dissolve the blue vitriol in several gallons of water, say one fourth the quantity to be used, or it may first be dissolved in a smaller quantity of hot water and then several gallons of cold water added. Slake the lime and make a thin whitewash, then pour this slowly into the solution of blue vitriol, stirring

thoroughly; then add water sufficient to make up the required quantity. Before using the mixture it should be strained through sacking or a sieve of some kind, with about a 1-16 inch mesh, to remove the coarser particles, which are liable to clog the nozzle of the pump. While spraying, the mixture should be kept thoroughly stirred up.

Iron vessels should not be used in preparing this mixture.

This formula is one fourth stronger than that recommended for spraying fruit trees.

For destroying potato bugs, Paris Green may be added to the Bordeaux mixture in the proportion of one half pound to fifty gallons.

The Bordeaux mixture may be applied to the potato vines with an ordinary watering pot, but one of the forms of spraying pump described in Bulletin No. 19 is much to be preferred. For small fields, and where the work is to be done by one man, the Knapsack pump is a good form; but for general use one of the force pumps which can be attached to a barrel will be found more satisfactory. The pump should be provided with a nozzle which will give a fine spray, the form known as the Vermorel is one of the best. Spraying pumps should be brass lined. They may be obtained through any hardware dealer or direct from the manufacturers. W. & B. Douglas, Middletown, Conn.; George Tyler & Co., 43 South Market st., Boston; Field Force Pump Co., Lockport, N. Y.; Nixon Nozzle and Machine Co., Dayton, Ohio, are reliable firms. Blue vitriol may be obtained from any druggist, and in quantity ought not to cost more than ten or twelve cents, and may be obtained for even less at wholesale. Twenty-five to fifty pounds for three applications per acre will be required.

The barrel with pump attached may be mounted on a cart or wagon which will straddle two rows of potatoes, while the horse walks between them. One man will be required to pump, and another to hold the nozzle. With fifteen or twenty feet of hose five or six rows can be sprayed on either side of the team, so that little damage will be done in the necessary driving over the field.

H. H. LAMSON.

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